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The efficacy of pulmonary physiotherapy in bariatric surgery: A comparative study

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Abstract

Aim: In this study, we aimed to compare the pulmonary functions in patients who have undergone laparoscopic sleeve gastrectomy (LSG) with and without pulmonary physiotherapy (PP).

Material and Methods: Participants were randomized and separated into two groups of 61 patients each. In the first group, PP and mobilization were advised, and in the second group, ony mobilization was advised and pursued by medicians. The treatment protocol began on the postoperative first day and continued until the postoperative first week. The parameters assessed were pulmonary functions, a 6-minute walk test (6MWT) for lung capacity.

Results: The average age of the participants was 42 ± 3.16 years. The outcomes of the parameters were significantly different in patients who received PP compared with the control group. Significant healing was revealed, as well as an improvement in all the parameters of participants who underwent PP compared with the control group (p = 0.017*,0.012*,0.077,0.027).

Discussion: In patients with morbid obesity who have undergone sleeve gastrectomy, with the help of pulmonary physiotherapy, respiratory functions improved, oxygen saturation increased, functional capacity increased and they were discharged early.

Keywords

Obesity, Pulmonary, Sleeve

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Introduction

Morbid obesity is a common disease in all developed countries, and the definitive solution is primarily surgery as the only option for patients who have not benefited from medical and supportive treatment. LSG, which has become almost the first step in bariatric surgery, also plays a significant role. After the bariatric surgery, patients lose weight, daily activities can be performed more effectively, and intra-abdominal pressure on the lung cavity decreases.

Pulmonary physiotherapy (PP) plays a significant role in the prevention of postoperative complications of bariatric surgery. Functional lung exercise decreased the length of stay in the hospital, and also possible complications such as atelectasis, pneumonia of pulmonary physiotherapy modalities were suggested [1].

Furthermore, pulmonary physiotherapy ensures adequate ventilation in the lungs, limited motion and increased muscle tone, and recommendations to contribute to good posture, and better rehabilitation program improve the patient's quality of life [2-4]. In this study, we aimed to compare the pulmonary functions in patients who have undergone laparoscopic sleeve gastrectomy (LSG) with and without PP .

Material and Methods

Pulmonary outcomes of 122 patients who underwent LSG in a tertiary bariatric clinic were evaluated retrospectively. The Local Ethics Committee approved this retrospective research (2020/8–decision number 173). The necessary consultations (endocrinologist, psychiatrist, pulmonologist, nutritionist) were made for the patients who applied before the operation. BMI values of all patients were > 40 kg/m2. Bariatric procedures were also performed by an experienced bariatric surgeon team.

Study protocol

Trial Design

Pulmonary physiotherapy was performed on Group 1 patients who have undergone sleeve gastrectomy for 7 days. The therapy process began from the first day to the 7th day. All exercises were performed by a physiotherapist in the clinic until the discharge period.

In the preoperative and postoperative periods, the following parameters were evaluated: oxygen saturation, respiratory function test, a 6-min walk test for functional capacity. Pre- and post-test evaluations were performed by a physician in the field of the study. The physiotherapy protocol included postural drainage, breathing exercises, and coughing techniques. All pulmonary exercises were repeated twice a day for a total of 8 times.

Participants were mobilized as immediate as possible, they walked 45 minutes along the aisle on the second day,

Participants

One hundred twenty-two patients who have undergone LSG were separated into two groups of 61 patients each . The presence of chronic respiratory disease, alcohol, smoking, and drug dependence were added as exclusion criteria.

Pulmonary Functions

Lung capacities were assessed utilizing a spirometer (Model 2010, Medizintechnik AG, Zurich, Switzerland) according to the Thoracic Society guidelines. Vital capacity, forced vital capacity, and maximal voluntary ventilation performances were used . The highest values of forced vital capacity (FVC), (FEV1), FEV1/FVC ratio, peak exhaling flow (PEF), vital capacity (VC) were determined.

Minute Walk Test

Participants were asked to walk for 6 min along the clinic corridor. Standardized suggestions were given in every 60 minutes. The maximum distance, which was performed at the end of the application was recorded [5].

Statistical analysis

Data were analyzed using IBM SPSS Statistics 26 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics were used to describe the basic characteristics. T-Tests were performed for indicating differences between the groups. P-value ≤ 0.05 was accepted as significant for all statistical levels.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

A total of 80 females and 42 males were included. The average age was 42.3 years, and body mass index (BMI) was 43.1 kg/m2, however there was no significant difference determined among the study groups. Each group included 61 patients (Table 1). Pulmonary functions of the participants after the procedure were assessed, and all values in the pulmonary physiotherapy group were found to be elevated, on the other hand, VC, TV, and FEV1/FVC outcomes were determined as statistically significant healing in pulmonary physiotherapy group ($p < 0.05$) (Table 1). The 6-minute walking test scores demonstrated a statistically significant increase after the physiotherapy process ($p < 0.05$). Furthermore, only 6-minute walking test was detected as significant elevation (Table 2).

Table 1. Demographic characteristics of patients.

	PP group (n = 61) Mean ± SD	Control group (n = 61) Mean ± SD	P value	Odds ratio (95% CI)
Age (year)	41.60 ± 4.84	43.70 ± 5.23	0.862	2.036 [0.955, 4.341]
BMI (kg/m^2)	45.32 ± 6.22	42.67 ± 9.12	0.918	1.895 [0.948, 3.789]
Duration of surgery (min)	65.50 ± 10.3	68.70 ± 5.47	0.236	1.436 [0.791, 1.525]
Duration of anesthesia (min)	82.10 ± 8.24	85.60 ± 6.31	0.163	2.575 [1.948, 4.382]
Length of hospital stay (day)	7.45± 1.3	8.17± 2.4	0.482	3.381 [2.931, 4.094]

PP, Pulmonary physiotherapy; BMI, body mass index; SD, standard deviation

Table 2. Comparison of post-treatment respiratory function test results.

	PP group (n = 61) Mean ± SD	Control group (n = 61) Mean ± SD	P value
VC (ml)	4.80 ± 1.76	2.48 ± 0.92	0.017*
TV (ml)	1.45 ± 0.28	0.57 ± 0.37	0.012*
FEV1 (ml)	2.43± 0.72	1.47 ± 0.63	0.077
FEV1/FVC (ml)	87.30 ± 4.56	72.50 ± 12.53	0.027
SaO2 (%)	95.80 ± 1.73	90.40 ± 2.38	0.001*
6MWT (m)	592.50 ± 116.82	439.70 ± 92.27	0.001

*p < 0.05; PP, chest physiotherapy; VC, vital capacity; TV, tidal volume; FEV1, forced expiratory volume in 1 s; FVC, forced vital capacity, SaO2, oxygen saturation, 6MWT, 6-min walk test; SD, standard deviation

Discussion

Morbid obesity disease is a common health problem all over the world, furthermore, this disease affects lung compliance worse than in the non-obese population. Bariatric Surgery is one of the most effective treatments for morbid obesity and has been demonstrated to positively affect pulmonary functions. Although there are some studies about pulmonary problems that may establish after a bariatric process, there are few studies about pulmonary physiotherapy enforcements for the early recovery time [4,6-8].

The aim of this research is to demonstrate that postoperative pulmonary physiotherapy resulted in increased respiratory function, saturated oxygen ratio, and functional capacity in participants after bariatric surgery. In addition, morbid obesity negatively affects lung function and decreases the contraction force of the pulmonary muscles.

Brovman et al. showed significant variation in TV in morbidly obese patients in the postoperative period. They also found significant improvement in pulmonary functions due to weight loss after the bariatric surgery and a reduction in pressure on the lung capacity. Pulmonary physiotherapy is a treatment modality especially in patients with morbid obesity. The real purpose of pulmonary physiotherapy is to rehabilitate the strength of exercise [9,10].

Lung capacity volumes were decreased after the surgical process, therefore, due to this process participants should force their bodies to walk as far as possible to prevent complications such as atelectasis, thromboembolism etc. In another study by Van Limmen et al., they found that FVC, FEV1 outcomes decreased after the laparotomy; besides, Borges-Santos et al. found a decline in pulmonary functions after the bariatric process on weight [11,12].

Because of this, pulmonary physiotherapy postoperatively is so important. Abdominal surgical process has demonstrated that expiratory reserve volume is reduced in morbidly obese patients compared to non-obese participants. The most common complication after the bariatric process is atelectasis, which is also determined in nearly 40% of the population. For this reason, pulmonary physiotherapy is the most significant therapeutic approach for the prevention of possible pulmonary complications [13,1]. Pouwels et al. showed that participants who have taken pulmonary treatment had elevated inspiratory muscle strength and maximal inspiratory pressure (MIP) on postoperative 3rd and 6 th months and achieved greater improvement than the control group [14].

Furthermore, a study by Umemura et al. found that patients who have undergone bariatric procedure supported with pulmonary physiotherapy experienced greater postoperative healing than those who have not undergone[15]. Tomich et al. reported that in obese women, breathing exercises are particularly effective with the volume-oriented device, and this leads to increased inspiration volume and reduced possible complications after bariatric surgery [16].

In the present study, it was shown that the participants who underwent pulmonary physiotherapy demonstrated an increase in pulmonary functions after the surgical process. Furthermore pulmonary rehabilitation aid to patients for decreasing the complications such as atelectasis and also pneumonia Besides that 6MWT is utilized for evaluating the differences in lung capacity after the pulmonary rehabilitation process. Desy Salvadego et al. reported that respiratory muscle endurance training (RMET) with body mass reduction program in obese participants resulted in a reduction in the O2 cost of cycling and perceived exertion during constant heavy-intensity exercise, and also this exercise program strengthened respiratory muscles. Furthermore, the meta-analysis by Li et al., have analyzed 11 RCTs and demonstrated an important improvement in the 6MWT post-intervention distance [18]. The 6MWT is widely utilized for evaluating walking capacity [19-23]. This is a convenient and safe process to evaluate the functional capacity of morbidly obese patients who have undergone the bariatric process [24, 25].

Present study outcomes have shown that participants who underwent pulmonary physiotherapy were determined as 51 % recovery in a 6-min walking distance. According to these outcomes, it has been found that the exercise volume of patients who have undergone surgery, particularly bariatric surgery, can be improved by pulmonary physiotherapy.

In the literature review, our study is one of the rare studies, which evaluate the lung capacity and exercise performance by applying the pulmonary physiotherapy.

There are also some limitations in the present research. First, the follow-up period is short and patients were not called again for follow-up in the first year, Secondly, high-resolution computed tomography was not utilized to show possible pulmonary complications.

Conclusion

As a conclusion of this research, pulmonary physiotherapy, which is performed on morbid obese participants in the postoperative period has improved lung functions, oxygen saturation and also functional capacity in those who have undergone bariatric surgery.

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Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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